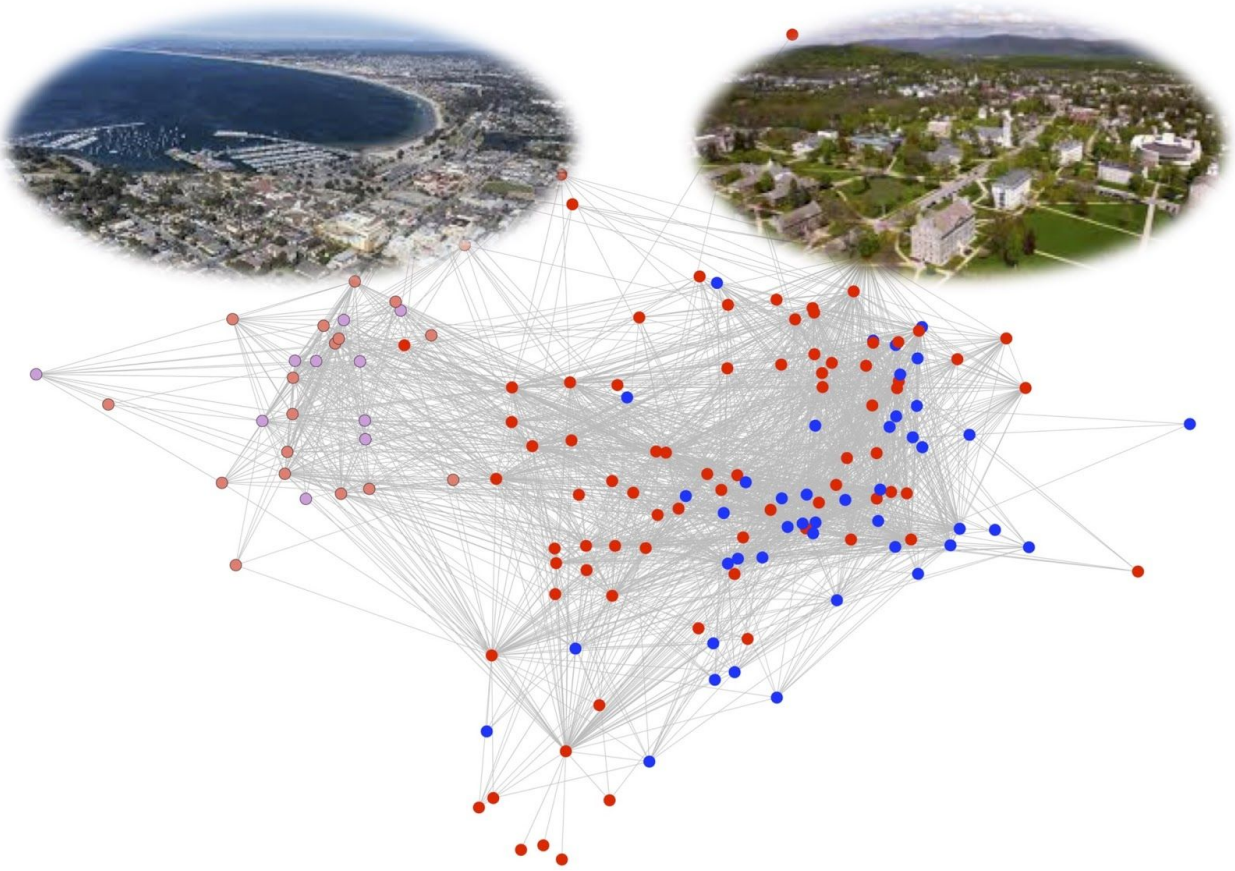
META Lab

The Mixed-Methods Evaluation, Training, and Analysis Lab

Social Network Analysis of the Middlebury Ecosystem



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1 Executive Summary

1.1 Summary of Key Findings

Network visualizations are commonly employed as a means for quickly assessing the overall structure of a network. These assessments provide clues to the analyst as to how the analysis should proceed. In the Middlebury ecosystem network, initial visualizations revealed a distinct tendency for what appear to be unique subcultures that are embedded within a larger system.

The pattern was consistent across different aspects of the network - even though each of the various aspects measures a different and unique type of working relationship at the institution. The internal consistency of the three unique aspects lends credibility to the later conclusions that were developed with these data.

The initial observation of two possible subgroups within the Middlebury ecosystem was investigated at length, given the possibility of concerns over the continued integration of the wider Middlebury community. It was found that the two aspects intended to measure that ties that govern the flow of resources and information throughout the Middlebury ecosystem indicated somewhat sparse connections between the Vermont and California campuses. The aspect that measures aspirations for establishing new ties, however, indicated that there is actually a good deal of potential interest in broadening and strengthening the ties between campuses.

Whereas the network aspects that measure the ties that are currently present in the Middlebury network found that there are connections between the two campuses, the aspect that elicits the potential for future connections indicated that interest in continued integration persists. Subsetting the network into faculty and staff subnetworks allowed for closer scrutiny into two other very different cultures within the Middlebury ecosystem. As may be expected, each subnetwork exhibits a unique pattern of connections, which may point to two very different approaches to fostering continued integration within each.

This work is intended to inform the reader as to aspects of the Middlebury ecosystem that may not be immediately clear upon casual examination. A small collection of measures and concepts are presented in the course of this report that should provide insight into the various offices, departments, and programs within Middlebury. It is strongly suggested that these be used as an indication of *potential for*, rather than determinants in, the continued growth of the Middlebury ecosystem.

Larger versions of the figures presented in this report are available at:
https://sites.google.com/site/middleburysna/

1.2 Acknowledgements

This work has been possible only because of the many people in Vermont and California.
The participation of the office of the Director of Assessment and Institutional Research, and the Director, Mrs. Adela Langrock, was instrumental in ensuring that the MIDD Connections survey complied with both the letter and spirit of Middlebury rules, while understanding the full array of other data collection efforts taking place simultaneously.
The Office of the Provost (Provost Susan Baldridge, Associate Provost for Integration Strategies Amy McGill, Associate Provost for Planning LeRoy Graham) provided the overall direction of the process and served as liaison with the Office of the President, and the Board of Trustees and all its relevant committees.
Karen T.Cuenco provided early edits and welcome advice on the layout and tone of the report.
The Graduate Assistants at the META Lab worked tirelessly to overcome significant technical and operational challenges. We are grateful to Rachel Dickinson, Brendan Knapp, and Shannon Nolan for the many hours they have put into this report.

2 Introduction

2.1 How to Read this Report

Social networks are essentially snapshots of the interrelationships between a set of various entities. The wide variety of relationships that may provide a link from one entity to another present opportunities to evaluate a network for a variety of analytic goals. So, consider the three Middlebury networks depicted below as being representative of where Middlebury is today in terms of the flow of resources and information; and where it may be headed in the future, in terms of future connections.

The relationships that were analyzed were both existing (i.e., Collaboration & Communication), and potential (esteem[1] for others). The latent ties, in particular, can be very informative for identifying the "low-hanging fruit" in establishing further interconnections within the Middlebury ecosystem. The manifest ties of collaboration and communication serve mainly as a means of assessing the current state of the relationship structure in the Middlebury ecosystem.

The field of Social Network Analysis is rife with specialized terminology and analytic detail. We have, for the most part, avoided the use of any specialized terms or references to the analyses that produced the results that are presented in this report. We have instead chosen to present the findings informally, a manner that is closer to informal English.

Later reports will focus on presenting an expanded, and more formal, treatment on what was analyzed. Should the reader so desire, the authors of this report are happy to answer questions about how particular visualizations, measures, or analyses were performed. But the focus for the present work is on accessibility of interpretation in what can be a fairly intensive field.

The remainder of this report is organized into six main sections:

- Project description
- Visualizing the Middlebury Ecosystem
- Faculty Network within the Middlebury Ecosystem
- Staff Network within the Middlebury Ecosystem
- Conclusions
- Appendices

The *Project Description* outlines how and why this project developed. The report then proceeds in *Visualizing the Middlebury Ecosystem* to consider what the three types of relationship

[1] In the context of this paper, esteem refers to a relationship that the respondent would like to establish in the future, based on potential mutually beneficial results; an 'aspirational' link or tie.

(collaboration, communication, and esteem) reveal about the overall Middlebury ecosystem. This section offers a little extra explanation of how to approach and interpret network visualizations, and then gives some interpretation of the three networks and their particular implications.

Strong interest in the continuing integration between the various Middlebury campuses inspired the inclusion of report sections that provide individual consideration to faculty (*section 5*) and staff (*section 6*) subsets of the Middlebury ecosystem. Each of these two sections begins with the presentation and description of the sub-network visualizations, and then continues to discuss how to identify the potential that some structural roles within each network suggest.

The report closes with some brief *Conclusions* and appendices. The appendices contain all the network visualizations that appear elsewhere in the report. This was intended as a means of providing graphics that are larger and more legible than the report can normally accommodate.

Those already familiar with social networks or social network analysis could easily skim the report for the graphs, tables, and charts. All others are encouraged to read the preceding section on networks and social network analysis, and pay special attention to “A Note on Interpreting Visualizations” in the *section 4.1* . That section is intended to familiarize people new to the network analysis with what they should seek when considering a network visualization for the first time.

2.2 A Note on Social Networks and Social Network Analysis

Although the roots of the field can be traced to the 1800's, with the advent of Sociometry, social network analysis is generally treated as a relatively new field - relative to similar analytic domains. In its essence, social network analysis is a mathematical subset of sociology. As such, the field centers on relationships between entities.

The social network analysis of the Middlebury ecosystem is concerned with the connections between the people, offices, and departments that make it the unique institution that it is. Social networks are a representation of how people, organizations, or other entities interact every day. However, such networks are seldom explicit. Those reviewing a network for the first time tend to experience a combination of recognition and revelation, but most focus on the recognition aspect.

Readers who are familiar with the group or institution being analyzed will frequently find that there is a great deal that they recognize about the network - relationships that make sense; connections that should be obvious; and so forth. The challenge, however, is to step away from the minutiae that make up the network and consider the structure of the network *as a whole*.

The overall structure of a network is usually a revelation. Most people can conceptualize dozens, and sometimes hundreds of relational ties between people or other entities. But networks of as few as 50 individuals can have a set of relationships that can number into the thousands. Moreover, it can be exceptionally difficult to order those relationships into a coherent structure. Rather, people tend to consider only very localized subsets of how they envision ties between the members of a network. As information processors, we are ill equipped to zoom out and consider the overall structure of a network - even if we could manage an accurate idea of the ties between the network's members.

A network's overall structure is therefore the primary focus of network analysis. We can, of course identify individual members of the network as having particular roles (e.g., information hubs, prominence, facilitators/bottlenecks), but those roles depend entirely on those individuals' placement within the network's structure. This placement will come from the ecosystem which is built through ties and relationships of all individuals. Therefore, it is more important to look at where individuals sit in the network in relation to others, rather than their exact coordinate position, as this depends on the specific visualization.

The overall structure of the network can also reveal the health of an organization. The visualization of a network will display how cohesively it is tied together. That visualized structure can also reveal potential for growth, trouble spots, positions of strength, important redundancies, or other organizational insights; depending on one's perspective.

It may be helpful to think of an individual network the same way one would consider a series of pipes or wires. The potentials that networks reveal are mainly concerned with *transmission*. When evaluating a network, think of it as a map of how stuff flows through it. Collaboration networks map the flow of resources. Communication networks map the flow of information and ideas. And networks of esteem document the flow of positive sentiment.

The social aspects that flow through a network reveal some of the social forces and norms that determine the character and health of the group or organization being considered. We all experience the social forces that help to regulate the way we behave. If the idea of "social forces" strikes you as dubious, then Google the following words: candid camera elevator.[2] The first result should be a video that will succinctly demonstrate the pressure to conform to group norms. Although the social forces that group conformity have been well documented and studied, you are also welcome to experiment with it yourself by facing the back of an elevator the next time you ride. The stress you feel is how we experience these "social forces."

It is, however, critical to keep in mind that the network must only be taken as an indication of the *potential* that may be found within a group or organization. There are no laws that prevent people from influencing those around them in a manner that is not accounted for by the network. The network is in no way a determination of how people will act, but merely a summation of the forces and flows present within a group, and a suggestion of what that structure may reveal.

In summary, network analysis is a powerful tool. Because of the unique perspective it offers, its use has expanded from sociology into areas such as physics, biology, medicine, business, trade, and further. But like any tool, its best use takes into account its limitations. In addition to the caveats mentioned above, keep in mind that this is merely a depiction of the Middlebury ecosystem from three perspectives, at one point in time. Additionally, this work is derived from the responses of 683 members of the Middlebury ecosystem; roughly thirty percent of those working for the institution. It is entirely possible that we have missed some ties that are present due to nonresponse. So it is reasonable to assume that there are some features of the network that are not perfectly represented.

This report is meant to focus the reader on some of the relational ties within the Middlebury ecosystem, and the implications that those ties suggest. Below, we offer suggestions for how to approach this report.

[2]Candid Camera Elevator: https://www.youtube.com/watch?v=BgRoiTWkBHU

3 Project Description

As a part of the *Envisioning Middlebury* effort, Provost Susan Baldridge sought a means to map the connections between all of the various elements of the Middlebury ecosystem in late summer of 2015. At the time, there had been no attempt to produce such a representation. After some consultation, it was determined that the most appropriate tool for this purpose was social network analysis.

The social network analysis of Middlebury is therefore concerned with the connections between the various entities (e.g., schools, programs, departments and people) that constitute the institutional ecosystem.

3.1 Survey Development

The launching of what came to be known internally as the “connections survey” coincided with other data collection efforts for the *Envisioning Middlebury* initiative. It was expected that survey fatigue could have substantial effects on response rate. As such, the team decided to limit the questions to three. Question development was undertaken as a collaboration between the Office of the Provost, the Office of Assessment and Institutional Research, and META Lab personnel.

Several challenges emerged in the question development stage. One was the need to provide enough context so that the respondents could provide answers that are meaningful and consistent across the multiple units of the Middlebury enterprise. Another challenge was how to make the mechanical process of answering the questions as easy as possible.

A third issue was the problem of communicating survey questions across to diverse audiences and multiple constituencies in a manner that is meaningful to all potential respondents. With the META Lab’s prior research experience (e.g., CASP Connections Survey), it was able to inform the process of designing a simple, yet complex survey instrument that could address these issues.

The “roster” approach to survey question design was employed in order to ease the burden of recall on the respondent. Rosters supply respondents with a list of people from which they may select all those who fit a particular description. In this case, the roster was presented in the form of a search box that may be used to search for names of Middlebury employees, or as a dropdown list of all Middlebury employees. Respondents could search by last name, first name, office, or department. Each selection populated a list that could be checked to eliminate unintentional selections. This resulted in a functionality that ultimately allowed the inclusion of up to 100 names for each of the three questions.

3.1.1 Eliciting Information about Relationships - Three Questions

The resulting Middlebury "Connections Survey" was designed to elicit three of the relational dimensions that may be used to define the interactions among its entities: collaboration, communication, and esteem. For each question, Middlebury faculty and staff were asked to select the names of those with whom they have that type of relationship.

Helper text was added to each of the three questions in order to aid potential respondents in framing and conceptualizing the question. Both the questions, and their associated helper text were developed through a collaboration between multiple representatives of the META Lab and the Provost's office.

3.1.1.1 Question to Evoke Collaboration Ties

> *"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you work most closely?*
>
> *Please think about people who make it possible for you to perform your work or research objectives. These may be any faculty or staff in your own department or across multiple departments and locations that provide a nontrivial contribution to your work."*

3.1.1.2 Question to Evoke Communication Ties

> *"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you communicate regularly in the course of your work?*
>
> *While you may not work closely with them, these are people from whom you regularly receive information that you value (e.g., through emails, phone calls, casual conversations, meetings.)"*

3.1.1.3 Question to Evoke Ties of Esteem

> *"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you aspire to work more closely?*
>
> *These are people who work in areas that interest you, or whom you admire. Perhaps you think that closer collaboration with them might be useful to you in your work."*

3.1.2 Survey Rollout

In preparation for a Spring 2016 rollout, the Digital Learning Commons produced a short video describing the *Middlebury Connections* project and the survey to come. By the time of the survey rollout in late April 2016, faculty and staff had been notified by email in both text, and video format. A final reminder to participate was sent out in June 2016, and the survey closed the following August.

3.1.3 Survey Response

Survey design and execution for social network analysis takes into account factors that can differ substantially from the concerns of surveys designed for regular statistical analysis. Regular - non-network - surveys generally employ a sample of people from within a population to make inferences about that population. In network analysis, we generally require a majority of people - or other entities - within a network to respond in order to conduct an analysis. This need for at least reasonably complete information can make data collection quite challenging.

Numerous activities were competing for the attention of faculty and staff at the time of the survey rollout. In addition to the many events and data collection efforts taking place through the *envisioning Middlebury* initiative, the Spring semester was coming to an end and individual workloads were nearing their peak. This impacted the response rate, and additional backup survey administration was not feasible. The final number of responses was 683 out of 2,205 eligible Middlebury employees (31%). While this number is less than ideal for evaluating the Middlebury network at the interpersonal level, analyses suggest that there is a very good representation of the Middlebury ecosystem at the interoffice/interdepartmental level.

Respondents and those they identified were therefore collapsed by office or department. The ties between offices or departments are a culmination of all responses from all representatives in that office. This allows for a more well-rounded representation of interdepartmental interactions, as well as allowing the network to be widely dispersed throughout Middlebury while still respecting individual privacy.

31% of Faculty and Staff Responding
Invitations to participate: 2205
Responses: 683

It is apparent that many respondents took the survey very seriously. Although the survey was only three questions long, some respondents reported that the process of identifying all of their connections was a challenge. There were a few who did not make it to the final question (esteem). Given that esteem was an indication of potential new ties in the Middlebury ecosystem, this was not deemed to be a threat to the validity of the analyses.

4 Visualizing the Middlebury Ecosystem

4.1 A Note on Interpreting Visualizations

When analyzing the Middlebury network, look for signs of integration, aggregation, and the presence of multiple pathways between groups. It is generally expected that there should be some unique clustering among offices and departments. But there should also be a fair amount of ties between such clusters as well. Given that the Middlebury enterprise constitutes a number of fairly distinct entities that are distributed over a very wide geographical area, it is interesting to explore how well the spatially distant campuses integrate in terms of collaboration. The Vermont and California campuses offer the most easily noted example of this.

When viewing the visualization of the Middlebury collaboration network, for example, look for evidence of extremes. Consider whether there appear to be small, insular subgroups that are relatively unintegrated. Also look for a massive tangle that has no apparent structure (also referred to as the “hairball”). While there are many other patterns that provide insight into the “health” of a network, those two should help when evaluating the Middlebury network.

Various network patterns may be taken to indicate the patterns of redundancy, brokerage, bottlenecks, throughput, integration, and so forth. For example, a network that exhibits a few dense clusters of well-connected individuals, but has few connections between clusters, is likely to be a representation of a few largely unintegrated subgroups. Conversely, a network that is essentially one massive tangle is considered to be highly interconnected, to the point of redundancy. While a fair amount of redundancy is generally considered to increase an organization’s potential for resiliency, too much can stifle creativity and innovation. For a healthy organization, the goal is frequently to achieve something in between those extremes.

Each extreme constitutes a trade-off. The less-integrated subgroups are frequently noted to offer opportunities for innovation and outreach for those interested in acting as a liaison or bridge between two dissimilar groups. Such actors frequently benefit from their relatively exclusive opportunity to convey unique information or resources between otherwise unconnected groups. On the other hand, such organizations may also be viewed as “stovepiped,” or otherwise circumscribed and closed subgroups. Such functionally closed subgroups are generally associated with minimal development and change that can be fostered through exchange of materials and ideas with those outside the group.

The other extreme, the hairball, enjoys rapid and frequent dissemination of materials and information throughout the group. The tradeoff is the massive amount of constraint that those within such networks will experience as they are forced to maintain a relatively large number of relationships - each of which will have the same access to all the same resources. Although

such networks may be viewed as egalitarian, their lack of unique islands of innovation and trade can result in an overall stagnation due to the lack of unique stimulating inputs.

A visualization allows us to develop initial impressions of the network and to quickly assess how well integrated those within the network have become. The inference that a network analyst draws from a visualization is strongly tied to the context in which the network is situated. If one does not have first-hand knowledge of the workings of the group or organization being evaluated, then it is important to enlist the aid of someone who can offer that insight. As you consider the following report, keep in mind what you do and do not know about the various portions of the Middlebury ecosystem. Be sure to enlist the aid of someone who can help you to fill in the gaps of your own knowledge as you interpret what you see.

4.2 Visualizing Middlebury in Three Dimensions

Each of the three questions in the connections survey was designed to identify some of the major aspects of relationships within an organization and their influence on what passes through an organizational network. Collaboration networks map the flow of resources and, to a lesser degree, trust. Communication networks reflect the flow of information; either by conduit, or by filter. The third question, esteem, reveals potential for the expansion and growth of the network.

The middlebury network is presented below in three aspects: each reflecting a distinct type of interorganizational relationship. When considering each network visualization, keep in mind what that relationship represents about the organization. Much of what drives the the initial formation of ties between individuals or groups tends to be pragmatic. People make the connections necessary to complete a particular task, or to pursue a particular interest. Maintaining ties to one another, however, is costly.

Network studies have demonstrated that one of the stronger predictors of a tie between two people is proximity. However, given the network perspective, the idea of proximity does not need to be in the physical sense. A person's "location" within a network can also be a strong predictor of the relationships that they will form.

For example, if person A has a several friends who all maintain a friendship with person C, then it is likely that person A will eventually form a friendship with person C. This is the idea reflected in the aphorisms of a friend of a friend becoming a friend, an enemy of an enemy being a friend, and so on.

The purpose that you should keep in mind when you consider the following visualizations is not, however, an examination of exactly who is linked to whom. Rather, you should consider whether the networks appear to be robust enough to inspire continued growth in the ties between individuals. Do there appear to be enough connections between groups to allow for colleagues to come in contact with one another, virtually or otherwise? Are there isolated groups, or portions of the network that are functionally cut off from the rest? Is there a pattern that would indicate shared sense of belonging? Or, does there appear to be something more akin to a hub-and-spoke structure, with semi-autonomous units linked mainly by one central substructure?

The resolution available in a document of this sort does not allow for a consideration of fine detail in the networks below. But the details of each network are less important than the overall structure of the network. Take this opportunity to evaluate the aggregate structure of each network, and, if you desire, you can access the networks electronically for the ability to zoom in for close up views of individual parts of a particular network.

A brief interpretation follows this section. Take a minute to look at each network and see if you can discern any overall structural patterns. If you have not already done so, consider reading section 4.1: “A Note on Interpreting Visualizations.”

Note: All of the network visualizations provided below are available to you through the following site: https://sites.google.com/site/middleburysna/

4.2.1 Middlebury Collaboration Network

Eliciting Question:
“Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you work most closely?”

Collaboration reflects the flow of resources and, to some degree, trust within an organization.

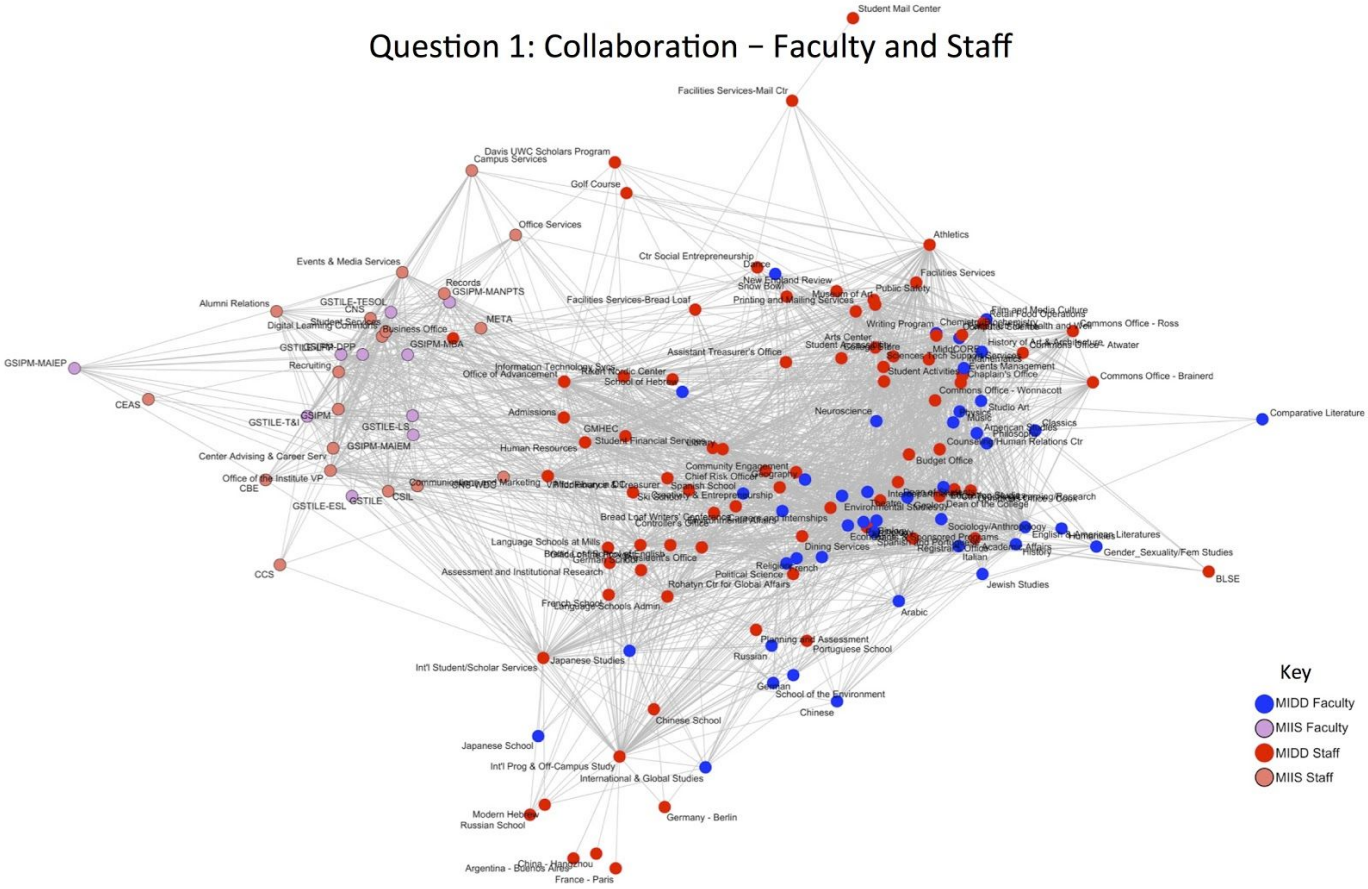

Figure 1: Visualization of the Middlebury *collaboration* network. The nodes within the network are *very generally* colored according to location and office. *(Blue = Middlebury Faculty; Red = Middlebury Administration and Staff; Pink = MIIS Faculty; Light Orange = MIIS Administration and Staff) Lines between nodes indicate that someone from one*

office identified someone from the other office as a collaborator who "...make[s] it possible for them to perform their work…"

4.2.2 Middlebury Communication Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you communicate regularly in the course of your work?"

Communication networks map the flow of information within a group or organization.

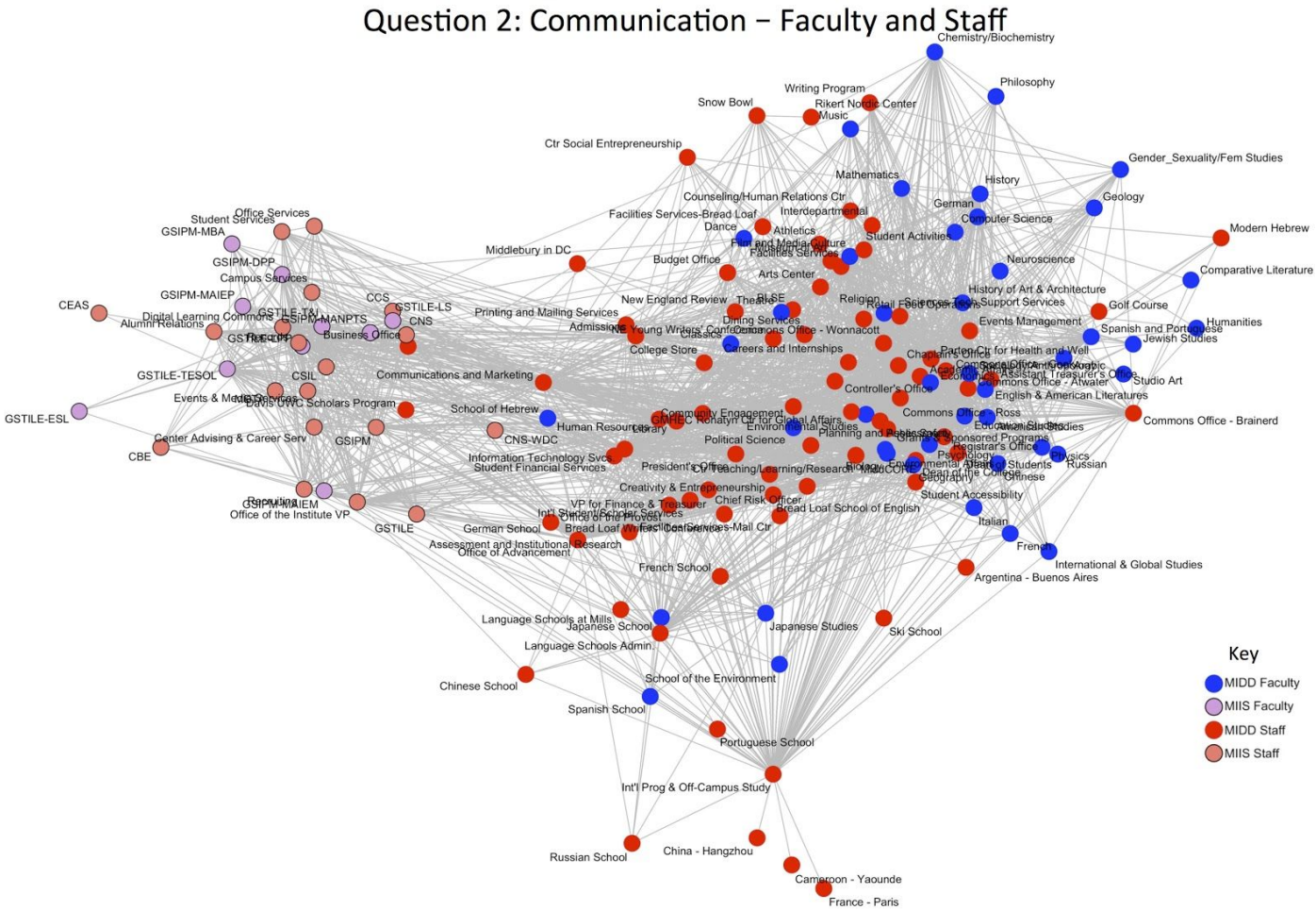

Figure 2: Visualization of the Middlebury *communication* network. The nodes within the network are *very generally* colored according to location and office. *(Blue = Middlebury Faculty; Red = Middlebury Administration and Staff; Pink = MIIS Faculty; Light Orange = MIIS Administration and Staff) Lines between nodes indicate that someone from one office identified someone from the other office as someone with whom they "...communicate regularly in the course of [their] work…".*

4.2.3 Middlebury Esteem Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you aspire to work more closely?"

Esteem is a reflection of aspiration. More than either of the two preceding networks, the esteem network is a relatively direct indication of future ties within the Middlebury ecosystem.

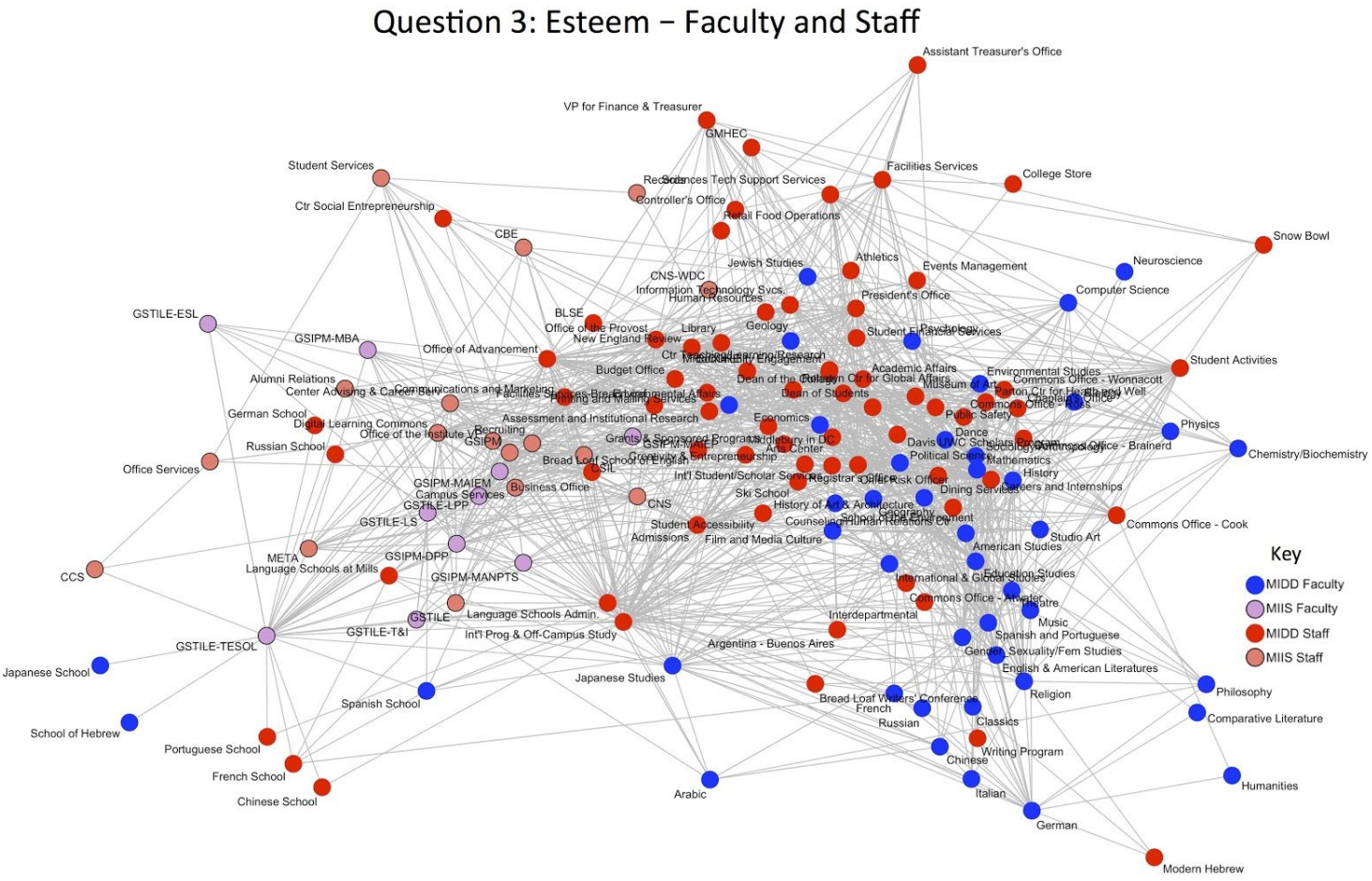

Figure 3: Visualization of the Middlebury *esteem* network. The nodes within the network are *very generally* colored according to location and office. *(Blue = Middlebury Faculty; Red = Middlebury Administration and Staff; Pink = MIIS Faculty; Light Orange = MIIS Administration and Staff) Lines between nodes indicate that someone from one office identified someone from the other office as someone with whom they "...aspire to work more closely…".*

4.3 Brief Interpretation of the Full Middlebury Networks

Each of the three networks above maps a distinct aspect of the connections within the Middlebury ecosystem. Yet, the first two - Collaboration (Figure 1) and Communication (Figure 2) - bear a striking resemblance. The structure in the first two figures has come to be referred to as “the Middlebury heart,” or the “heart of Middlebury,” with the Monterey campus making up the left lobe of the heart, and the Vermont campus making up the right lobe. Although the pattern of ties differs substantially between the two visualizations (see the section below for more detail), the overall shape is persistent.

Both the collaboration, and the communication networks depict what appear to be interconnected faculties, with staff acting as liaisons between them. Although a great number of connections exist between the Vermont and California portions of the network, it is evident that the two are still in the process of developing collaborative ties to bridge the gap. This is not entirely unexpected, especially given the large physical distances between the two locations and the relatively brief amount of time that they have existed as a single institution.

It is important to note that the average density of ties in both of the first two networks, communication and collaboration, is robust. There are no clusters or groups that are functionally cut off from the rest. There is also no apparent dominance by a particular group, or set of groups. Either of these scenarios would indicate a restriction or filtering of the resources and information flowing through the network. In fact, despite the presence of a shape, the collaboration and communication networks display a structure that is much closer to being flat than hierarchal.

The heart pattern is not nearly as evident when one considers the third network: esteem (Figure 3). The esteem network does share the same general pattern of the California campus largely being on one side, and Vermont being mainly on the other. The order that was present in the communication and collaboration networks, however, is not nearly as pervasive. Though it is still far from being a random network, the esteem network does show much more of an egalitarian tendency than either of the others.

Provost Baldridge has offered the analogy of *paved walkways and cowpaths* to describe how connections form in a network like Middlebury. Paved walkways refer to the ties that may be logically expected to form: those between groups with similar interests. Cowpaths, on the other hand, are those connections that form in a less expected manner. Cowpaths emerge as people in a network take the path of least resistance. Such paths can sometimes appear counterintuitive, but they are frequently the product of proximity - either in physical terms, or in terms of one’s location within the network. An individual’s connections to others can bring them closer to others with whom they may not have previously considered aligning.

The esteem network appears to provide a stronger reflection of the paved walkways in Susan Baldridge's analogy. Whereas, there are interesting instances of cowpaths in the collaboration and communication networks. Possible interpretations of the lack of traffic on the walkways include inertia, opportunity, and physical proximity.

Educational institutions are often notable for their consistency. Such consistency can be a welcome source of comfortable stability, but they can also impede rapid growth. With the absence of the serendipitous encounters that individuals experience when in close proximity, the Middlebury administration has fostered a program of exchange between campuses. The opportunities that have become available through exchanges such as M-Squared are likely reflected in the communication and collaboration networks, but their effect is likely much more visible in the esteem network. Potential ties, however enticing, can sometimes be difficult to realize in a short span of time in environments such as this.

When interpreting the three networks above, it is important to keep in mind that each one represents a very distinct tendency. The distinctions between the three networks were therefore verified. Results are provided in the section below.

4.4 How Well the Three Aspects Correspond

The similarities in patterns, however slight those similarities may be, raises questions as to the distinctness of the three networks. If the networks actually represent three distinct concepts, then the networks themselves are likely to vary at least somewhat. If it turns out that the three networks share a great deal of similarity, that brings into question whether these are just three slight variations on a single relationship, and whether the wording of the questions was poor.

Correlations reveal little reason for concern about redundancy between networks. The networks are, in fact, surprisingly different in terms of their tie structure. The two most apparently similar network visualizations, collaboration and communication, are only weakly correlated ($r=0.20$, $p<0.05$). The strongest correlation between networks - between collaboration and esteem - is only moderate in strength ($r=0.39$, $p<0.05$), and these visualizations look quite different to the eye.

Table 1: Correlation coefficients for the three aspects of the Middlebury network. All correlations are significant at the 0.05 level, using quadratic assignment procedure (QAP) for hypothesis testing.

Networks Compared	Correlation
Question1: Collaboration and **Question 2: Communication**	**0.20**
Question 1: Collaboration and **Question 3: Esteem**	**0.39**
Question 2: Communication and **Question 3: Esteem**	**0.15**

The hypothesis tests run on the correlation coefficients indicate that the three networks are distinct from one another, but not so distinct that the similarities could occur by random chance. We are likely safe to interpret this as an indication that respondents answered the questions faithfully, and that there is some modest conceptual overlap between the three aspects. It may, therefore, be surprising to note that collaborators are not strongly related to information sources. It is similarly interesting to note that the network of esteem does not appear to be at all strongly related to the information network.

4.5 Degrees of Separation in the Middlebury Ecosystem

There appears to be a tendency for distances between groups in the network to correspond with the actual physical distances between campuses. Moreover, this phenomenon of network distances reflecting physical distances appears to be particularly apparent when considering distances between faculty, most of which are on the periphery of the networks with mainly staff offices filling in the middle. With this stark visual separation of campuses in mind, we turned to analysis to reveal more about the networks. In fact, each of the three aspects of the Middlebury network presented above reveal what turns out to be a misleading pattern, with the separation between them not as pronounced as it seems.

Those familiar with the “Kevin Bacon Game,” or the concept of “six degrees of separation” should have little trouble conceptualizing “distances” within a network. Both of the aforementioned phenomena refer to how many friends of friends - or similar - a person would have to go through in order to reach a particular person. The number of people - or steps - is referred to as the “degrees of separation” between one person and another.

Further investigation reveals that the separation between individual offices and departments is not necessarily as stark as it may appear. In fact, when considering the lines connecting the various offices and departments as a map, the average distance between any two departments is less than two steps. Another way to state this is that the average shortest path within the network is 1.9 “steps”. Or you may consider this to be - on average - Middlebury’s *two degrees of separation* in its collaboration and communication. When thinking in terms of the flow of resources and information, on average, offices or departments are no more than two steps apart.

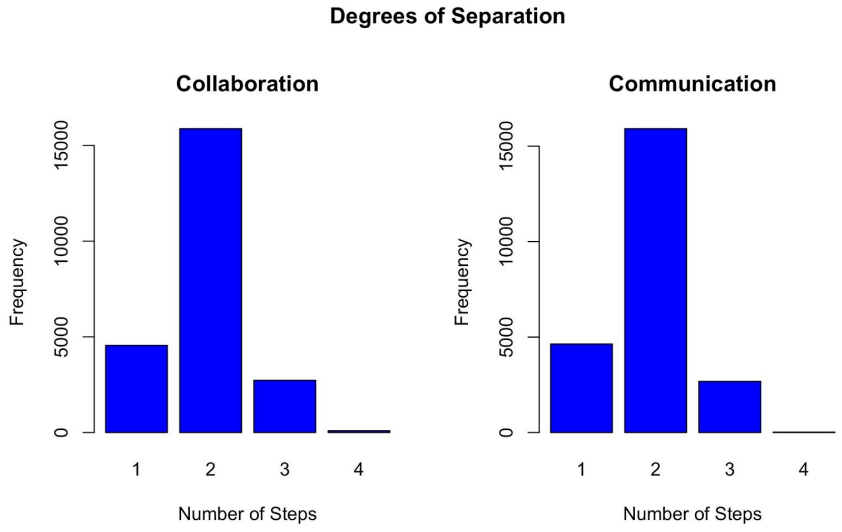

Figure 4: Histograms displaying the distribution of shortest paths within the Middlebury Collaboration and Communication networks. Note: The two histograms are very similar, but not identical.

4.6 Assessing Potential Liaisons

Another way to consider collaboration and communication between campuses is to consider the frequency with which one office acts as a go-between, or liaison, linking two dissimilar others. In this case, “dissimilar” refers to differences between location, or differences in role (i.e., faculty, staff). In this manner, a liaison can be seen as an entity that mediates contact between others.

The frequency with which each office acts as a liaison was calculated for the two networks that indicate actual kinetic resource flow within the network. Liaison calculations were not performed for the esteem network, given that it is a measure of a potential, and not actual, flow of resources through the network.

The liaison scores in the collaboration and communication networks (Figures 5 & 6) reveal that, at present, the top 20 liaisons in the Middlebury enterprise are almost all among administration and staff. This makes sense, given that this is frequently their explicit role. However, when making these liaison calculations, we used location as well as the faculty/staff designation to differentiate between offices. The liaisons in Figures 5 & 6 take into account an A -> B -> C relationship between three groups: Staff, Midd Faculty and MIIS Faculty.

The staff and administration are the most pervasively apparent liaisons between faculty on the two campuses. In this manner, they are performing their mandated function as the “glue” holding Middlebury together. It is expected that - at some point - more liaisons should emerge from within the faculty groups.

There is a great deal more nuance that is possible in identifying liaisons in a network. There are also a number of alternate methods for us to investigate the presence of liaisons within a network in a manner that does not need to take attribute designations such as location or type of office. Although such investigations are possible, and indeed have been performed, the information above is the best starting point for a discussion of the present state of the Middlebury enterprise.

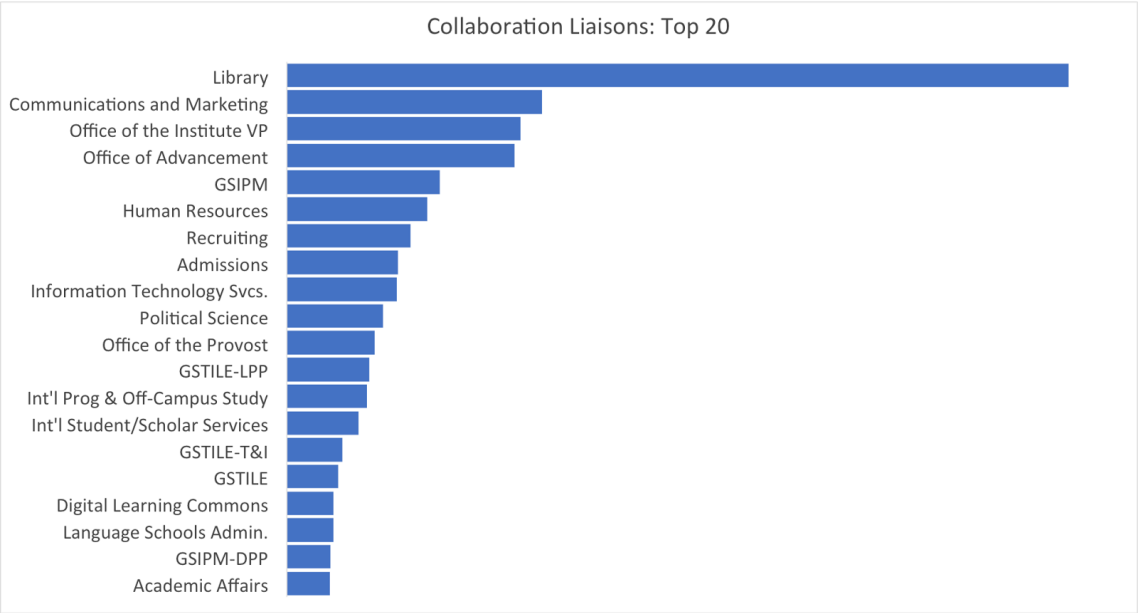

Figure 5: Top twenty liaisons from the full *collaboration* network. Liaisons are measured as the frequency with which a group acts as a connection between two dissimilar others. Longer bars indicate a greater potential for acting as a liaison.

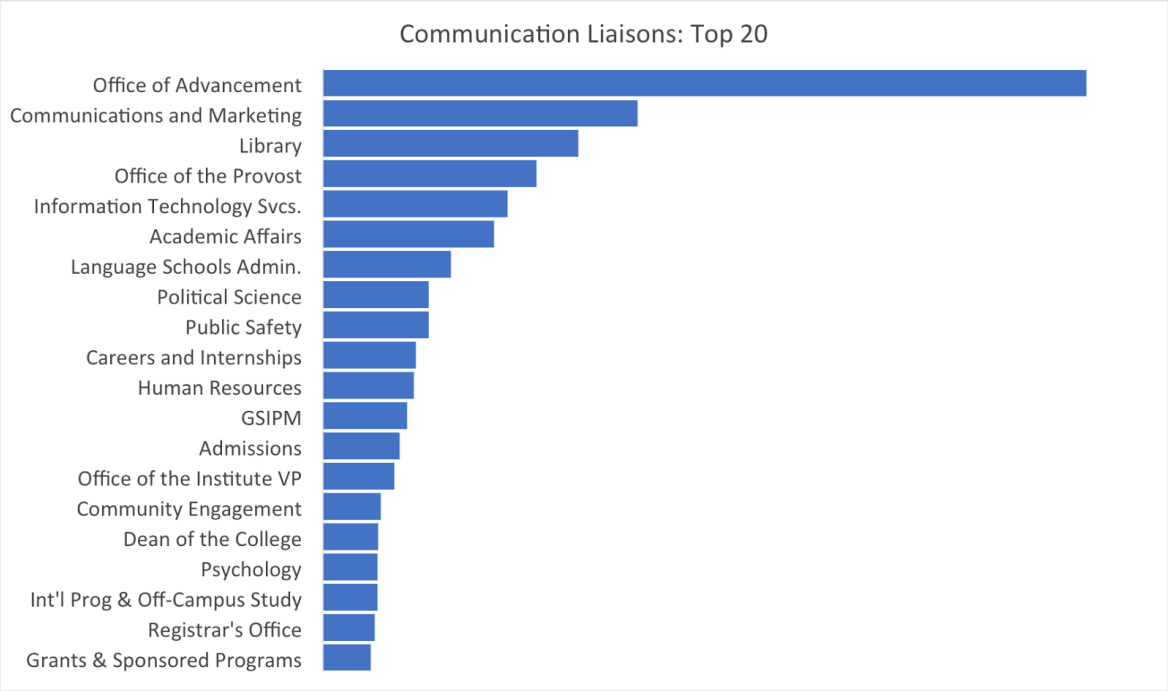

Figure 6: Top twenty liaisons from the full *communication* network. Liaisons are measured as the frequency with which a group acts as a connection between two dissimilar others. Longer bars indicate a greater potential for acting as a liaison.

4.7 Section Summary

Visualizing the three aspects of the Middlebury enterprise network reveals a few consistencies between what are in actuality distinctly different networks. All three networks appear to share a dense and cohesive overall structure. Within that structure, however, is a notable regularity: a distinct pattern of ties that corresponds closely to physical location. That, in itself, is not surprising, as proximity tends to have a great influence over how ties are formed.

The structural similarities in the three visualizations are actually misleading. Correlations confirmed that the three networks are distinct from one another. The three networks should, therefore, each be considered as offering unique information. The three aspects of the Middlebury ecosystem should therefore be interpreted as reflecting a distinctly unique aspect of the network.

Moreover, the appearance of separation between lobes in the network is somewhat misleading. On average, those in the Middlebury ecosystem enjoy less than two degrees of separation. Much of this the cohesion that this implies, though, appears to be due to the efforts of staff and administration in linking disparate faculty groups. This begs the question of whether staff and administration are the only thing holding two faculty groups together.

That is the question that is addressed in the following section. If staff are separated from the network, how well will the remaining faculty still be linked?

5 Faculty Networks within the Middlebury Ecosystem

5.1 What is holding the network together?

Network visualizations and the identification of liaisons within the three network aspects presented in the previous section revealed a notable consistency: faculty tend to occupy the outer lobes of the Middlebury heart, whereas staff and administration occupy the space inbetween. This begs the question of whether faculty in each location have indeed begun to integrate, or whether staff are the only factor uniting them.

Although integration of faculty and staff is what allows the Middlebury Enterprise to function, it is important to investigate how well each of these two - broadly defined - groups have begun to integrate within and across locations. The union of two previously separate groups is best viewed in the absence of additional information. It is, therefore, helpful to view each of these subsets of the Middlebury ecosystem - staff and faculty - in the absence of the other.

As such, we will consider faculty networks and staff networks over the two remaining sections to provide the opportunity for deeper exploration into each. The present section considers only links between faculty, and the section to follow is concerned solely with staff and administration. Both sections are concerned with assessing cohesion within the respective subsets and evidence of the potential for integrative activity.

As with the previous section, the evaluation of the Middlebury faculty network begins with a consideration of the visualized networks in each of the three aspects - collaboration, communication, and esteem. The focus then shifts to take the role of faculty liaisons into account, as these roles are likely critical to the fostering of future ties within the network. The section concludes with a presentation of another form of facilitation: throughflow. Throughflow enumerates the potential for individual members of the network to affect the efficiency with which information or resources flow throughout the network. Whereas liaisons represent the fostering of future ties, throughflow represents the current state of efficiencies within the network.

The visualizations below depict the Middlebury faculty network, as reported by faculty respondents. When considering this network, keep in mind the same comparisons that were used to assess the entire Middlebury network.

5.1.1 Faculty Collaboration Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you work most closely?"

Collaboration reflects the flow of resources and, to some degree, trust within an organization.

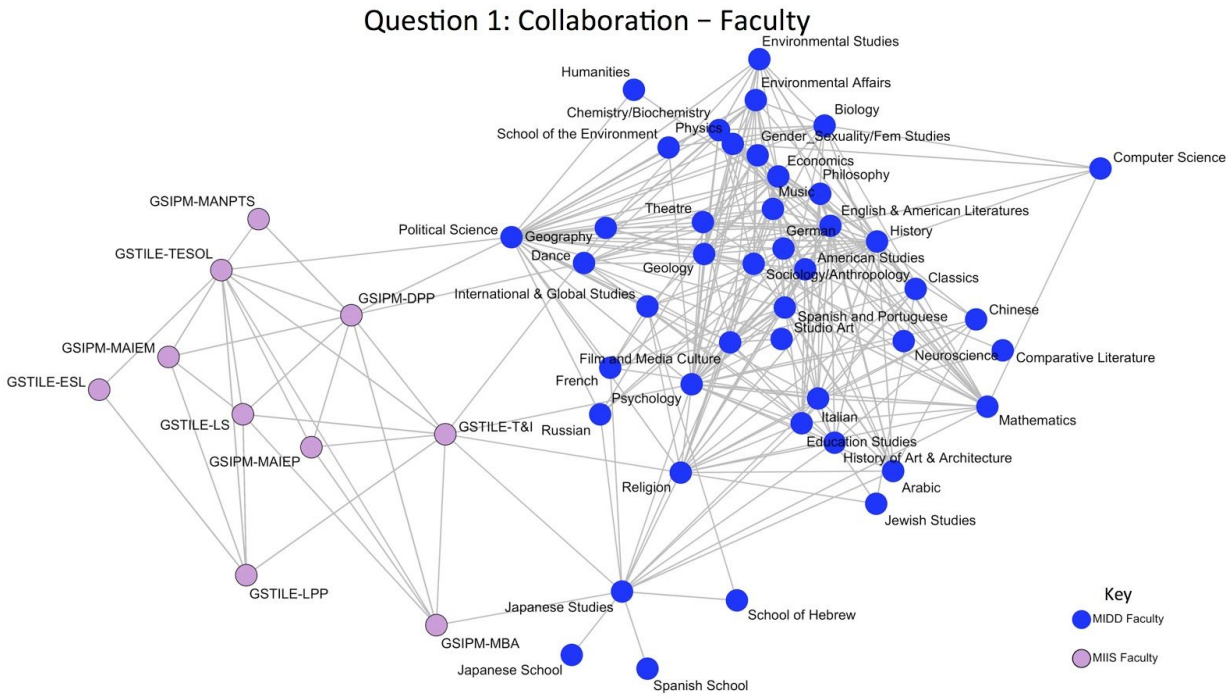

Figure 7: Visualization of the Middlebury faculty collaboration network. The nodes within the network are various faculty departments and programs. Lines between nodes indicate that someone from one department or program identified someone from the other as a collaborator who "...make[s] it possible for them to perform their work…".

5.1.2 Faculty Communication Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you communicate regularly in the course of your work?"

Communication networks map the flow of information within a group or organization.

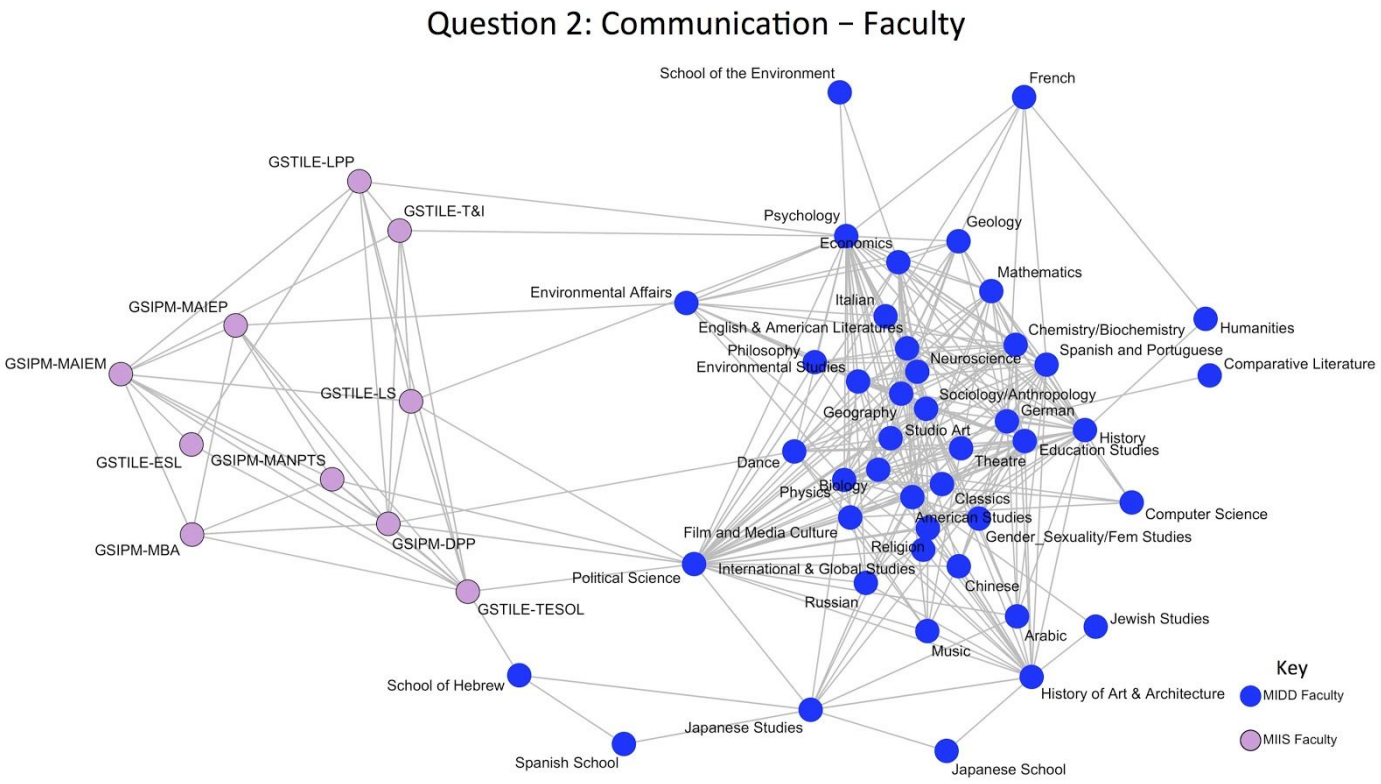

Figure 8: Visualization of the Middlebury faculty communication network. The nodes within the network are various faculty departments and programs. Lines between nodes indicate that someone from one department or program identified someone from the other as a colleague with whom they "...communicate regularly in the course of [their] work…".

5.1.3 Faculty Esteem Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you aspire to work more closely?"

Esteem is a reflection of aspiration. More than either of the two preceding networks, the esteem network is a relatively direct indication of future ties within the Middlebury ecosystem.

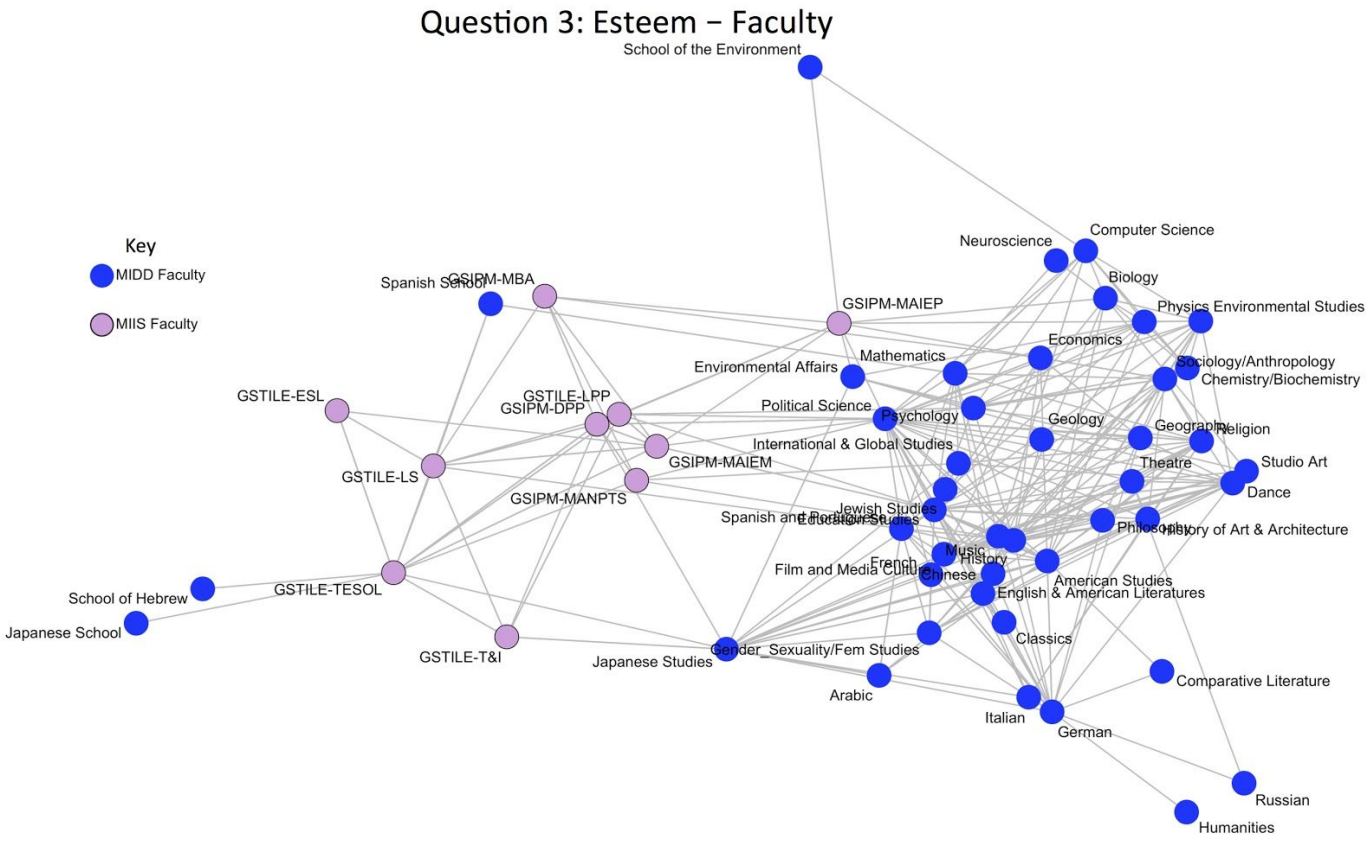

Figure 9: Visualization of the Middlebury faculty esteem network. The nodes within the network are various faculty departments and programs. Lines between nodes indicate that someone from one department or program identified someone from the other as a colleague with whom they "...aspire to work more closely…".

5.2 Brief Interpretation of Middlebury Faculty Networks

While the two campuses are connected, there remains realized potential. The Middlebury faculty collaboration and communication networks (Figures 7 & 8) depict the connections that exist between faculty groups on each campus. While each campus is easily discerned in these visualizations, it is apparent that administration and staff are not the only force holding the two locations together. However, there is obviously a good deal of opportunity remaining for various faculty to capitalize on the currently sparse connections between locations.

Esteem is a good indication of some of the unrealized desire for collaboration. The potential for greater collaboration between campuses is much more evident in the esteem network (Figure 9). Although the network is more sparsely connected overall, there are more ties that act as potential bridges between campuses. The crossover in some of the language-oriented schools is also a notable. Many of the ties that constitute the esteem network fall into the category of low-hanging fruit - or the ties that one may logically expect to form between similar groups.

Once again, Susan Baldridge's analogy of paved walkways and cowpaths appears to describe the connections present in the various aspects of the faculty network. As mentioned in section 4.3, paved walkways refer to the ties that may be logically expected to form: those between groups with similar interests. Cowpaths, on the other hand, are those connections that form in a less expected manner; generally from a those taking advantage of serendipity or a path of least resistance.

It is much easier to make out the paved walkways of expected connections and the emergent cowpath-style ties in the faculty networks - largely due to the decrease in complexity since we are dealing with a smaller subset of the network. Again, there is some evidence of the expected ties forming between departments and programs from complementary disciplines. There is also some evidence of the more serendipitous cowpath-style ties, such as the link between DPP and Middlebury Dance. As mentioned earlier, however, many ties that one may reasonably expect to see in the network are not evident in either of the two realized networks - collaboration and communication.

The *intent* to form both the cowpath and the paved walkway ties does, however, exist in the Middlebury system. Many such ties are clearly evident when considering the faculty esteem network (Figure 9). The opportunities that have become available through exchanges such as M-Squared are likely best reflected in the faculty esteem network.

The goal of overcoming institutional inertia among faculty groups will likely be aided through facilitating the aspirations that are reflected in the faculty esteem network. The role of liaison can offer some insight into how this could be realized. We explore this more in sections below.

5.3 Potential Liaisons

Keeping in mind that liaisons are identified by the frequency with which they act as a go-between, or bridge, linking two dissimilar others. In this case, “dissimilar” refers to differences between location only. In this manner, a liaison can be seen as an entity that mediates or encourages contact between others. The mediation or encouragement exerted by the liaison is not generally expected to be overt. Rather, much of the liaison effect on tie formation arises due to the increased network proximity that comes about as a liaison draws together dissimilar others within the network. Increased proximity - in terms of the ties within the network - increases the chances of a direct tie forming between the otherwise unconnected individuals.

The charts below present a list of the top ten departments, in terms of their tendency to act as a liaison. Liaisons in the faculty network are defined as connecting two departments from the two different campuses, no matter which campus the liaison department occupies.

Only the two relationships that indicate ties that are actually present - collaboration and communication - are considered. Ties of esteem are not as likely to engender further tie creation due to their ephemeral nature. It is, however, important to keep in mind that the liaison effect is only an indication of potential. Do not interpret liaisons as necessarily being intentional agents of tie creation within the network. Their role is more frustratingly indirect and subtle. Consider liaisons to be something more akin to catalysts. The areas in the network where they operate are, in this manner, likely to experience greater growth in tie formation than those regions of the network where there are fewer liaisons.

As you consider the charts in Figure 10 and Figure 11 (below) refer back to the visualizations above. Although the measures are taken only on the collaboration and communication networks, the lessons they impart can sometimes be seen in the esteem network. When there is a correspondence between a group’s status as a prominent liaison and prolific ties within the esteem network, it may be possible to consider that group to be an intentional agent of growth within the network.

Also keep in mind that liaisons within the collaboration network are essentially functioning as resource brokers, and liaisons within the communication network hold the potential to function as information brokers.

Note: For the full results of this and other measures, visit the companion website to this report: https://sites.google.com/site/middleburysna/

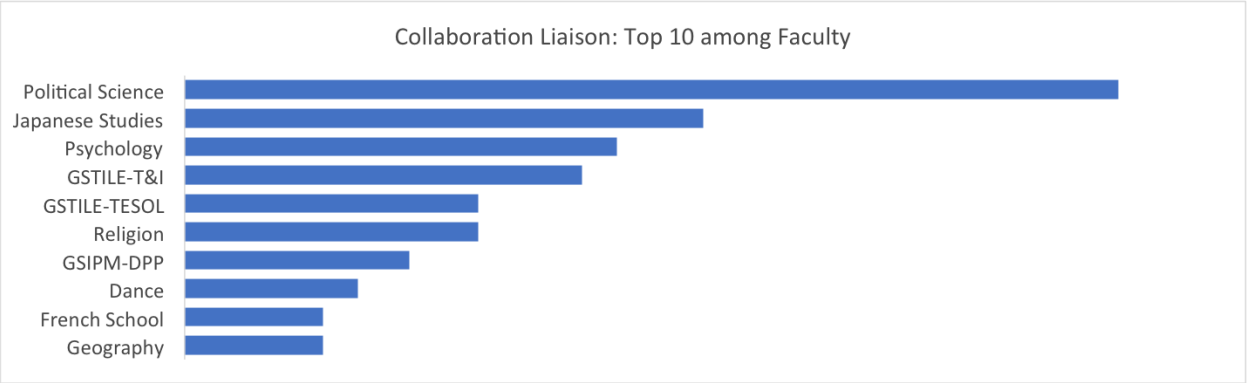

Figure 10: Top ten faculty liaisons from the faculty only *collaboration* network. Liaisons are measured as the frequency with which an office acts as a connection between the two campus locations. Longer bars indicate a greater potential for acting as a liaison.

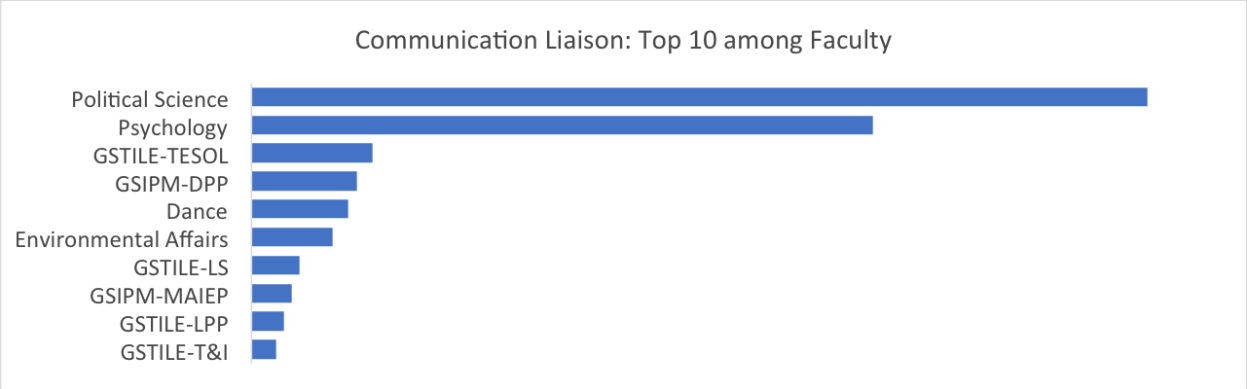

Figure 11: Top ten faculty liaisons from the faculty only *communication* network. Liaisons are measured as the frequency with which an office acts as a connection between the two campus locations. Longer bars indicate a greater potential for acting as a liaison.

5.4 Throughflow within the Network

It can also be helpful to consider how "central" a group is when considering the potential for individual departments to affect processes within a network. A common means of measuring centrality in a network is to measure a characteristic known as "betweenness," which we are referring to here as "throughflow." Regardless of the name that is used to describe it, this measure focuses on relative efficiencies within a network.

The groups that are identified as having high throughflow are those that occupy positions in the network that more frequently place them on the shortest path between all others in the network. Please note that a group that is identified as having high throughflow does not necessarily hold a position of dominance. Rather, they are in a position that may present advantages in terms of the frequency of resources or information that could potentially pass through them. As such, these positions are considered to function as *critical junctures* within a network, as groups that rate high on this scale often have greater opportunity to filter or control the flow of such goods.

The charts below observe the critical junctures or "throughflow" among the faculty only networks. Figure 12 presents the ten faculty departments or programs in terms of throughflow in the "collaboration network." Correspondingly, Figure 13 offers the same information in relation to the "communication network." More central positions within the network are indicated by longer bars.

As with the liaison measures, refer back to the visualizations above as you consult these charts. Think of high throughflow as a position of potential influence within the network.

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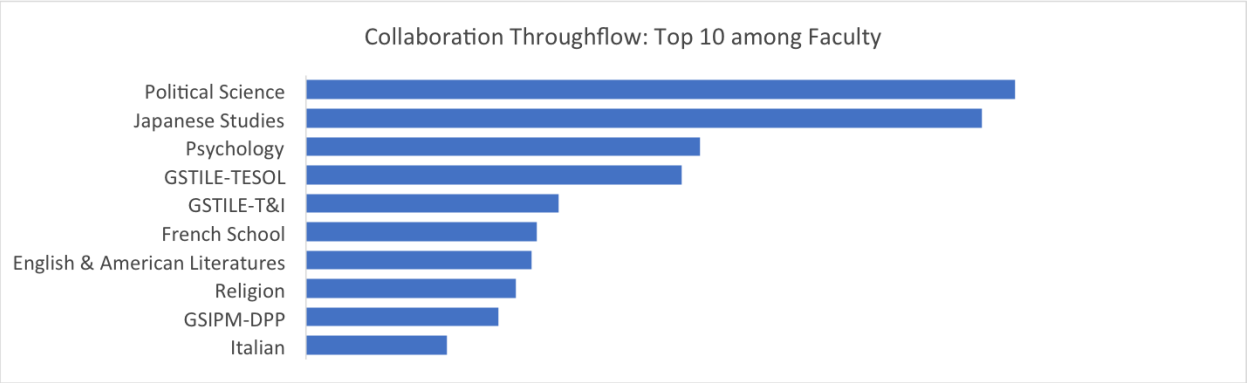

Figure 12: Top ten faculty departments and programs in terms of occupying "critical junctures" in the faculty only *collaboration* network. Critical junctures, or "throughflow", refers to the frequency with which groups lay on the shortest path between any two others in the network. Longer bars indicate that a department or program occupies a space in the network that is in the shortest path between any two others more often. Longer bars indicate more "central" positions in the network.

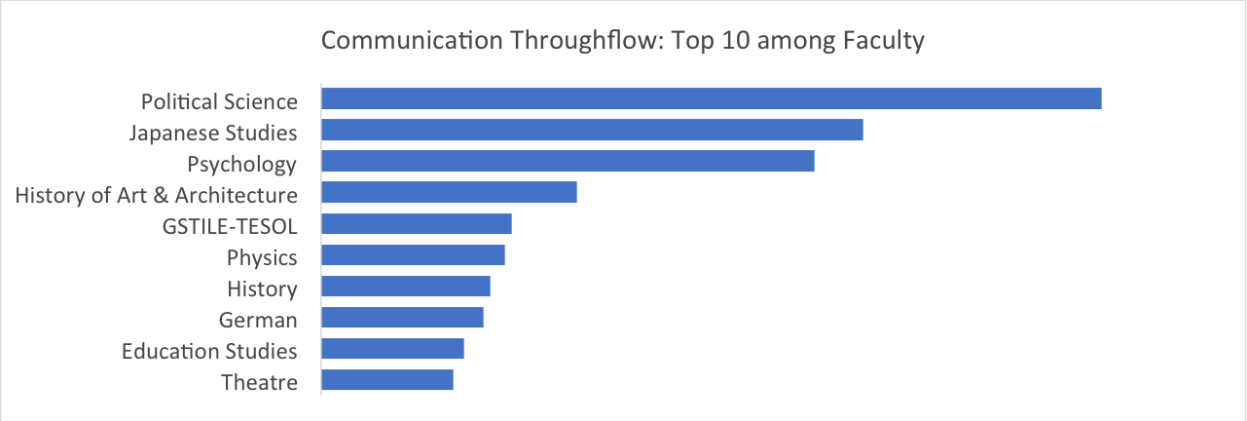

Figure 13: Top ten faculty departments and programs in terms of occupying "critical junctures" in the faculty only *communication* network. Critical junctures, or "throughflow", refers to the frequency with which groups lay on the shortest path between any two others in the network. Longer bars indicate that a department or program occupies a space in the network that is in the shortest path between any two others more often. Longer bars indicate more "central" positions in the network.

5.5 Section Summary

Subsetting the Middlebury network into faculty and staff networks allows for a more nuanced perspective on the state of current and future integration within the Middlebury ecosystem. The sparsity of ties between faculties of the Vermont and California campuses in most notable in the collaboration and communication networks, which represent existing ties within the network. This distance is much less apparent, however, when considering the potential ties that are represented in the esteem network.

The relatively larger number of ties that are apparent between campuses in the faculty esteem network could indicate that the relatively sparse ties that currently exist between campuses is either unintentional, or that there may be an emerging interest in the possibility of increasing intercampus ties. Departments and programs that feature prominently among liaisons may offer opportunities for facilitation of such ties. Additionally, those programs and departments that feature strongly in terms of throughflow within the network may similarly represent an opportunity to aid in the mobilization of information or resources throughout the network.

Pay particular attention to those programs and departments that score strongly on both liaison and throughflow, and appear to be particularly active between campuses within the faculty esteem network. Those groups are likely to represent easily reachable opportunities for further integration between campuses. As discussed, any new ties that draw disparate groups closer together hold the potential to engender still more ties between other disparate groups in the future.

6 Staff Network within the Middlebury Ecosystem

6.1 What is holding the network together?

As mentioned in section 5, initial visualizations of the collaboration and communication networks, coupled with the identification of liaisons within those same network aspects, revealed a notable consistency: faculty tend to occupy the outer lobes of the Middlebury heart, whereas staff and administration occupy the space inbetween. In addition, we have seen that the faculty network, while much more sparse than the full network, has potential for growth in collaboration and communication, especially as seen through the esteem network. This begs the question of whether similar forces may be noted within the network of staff and administration.

As with the previous sections, the evaluation of the Middlebury staff network begins with a consideration of the visualized networks in each of the three aspects - collaboration, communication, and esteem. The focus then shifts to take the role of staff liaisons into account, as these roles are critical to the fostering future ties within the network. The section concludes with a presentation of another form of facilitation: throughflow. Whereas liaisons represent the potential for fostering future ties, throughflow represents the current state of efficiencies within the network.

The visualizations below depict the Middlebury staff network, as reported by staff respondents. When considering this network, keep in mind the same comparisons that were used to assess the entire Middlebury network.

6.1.1 Staff Collaboration Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you work most closely?"

Collaboration reflects the flow of resources and, to some degree, trust within an organization.

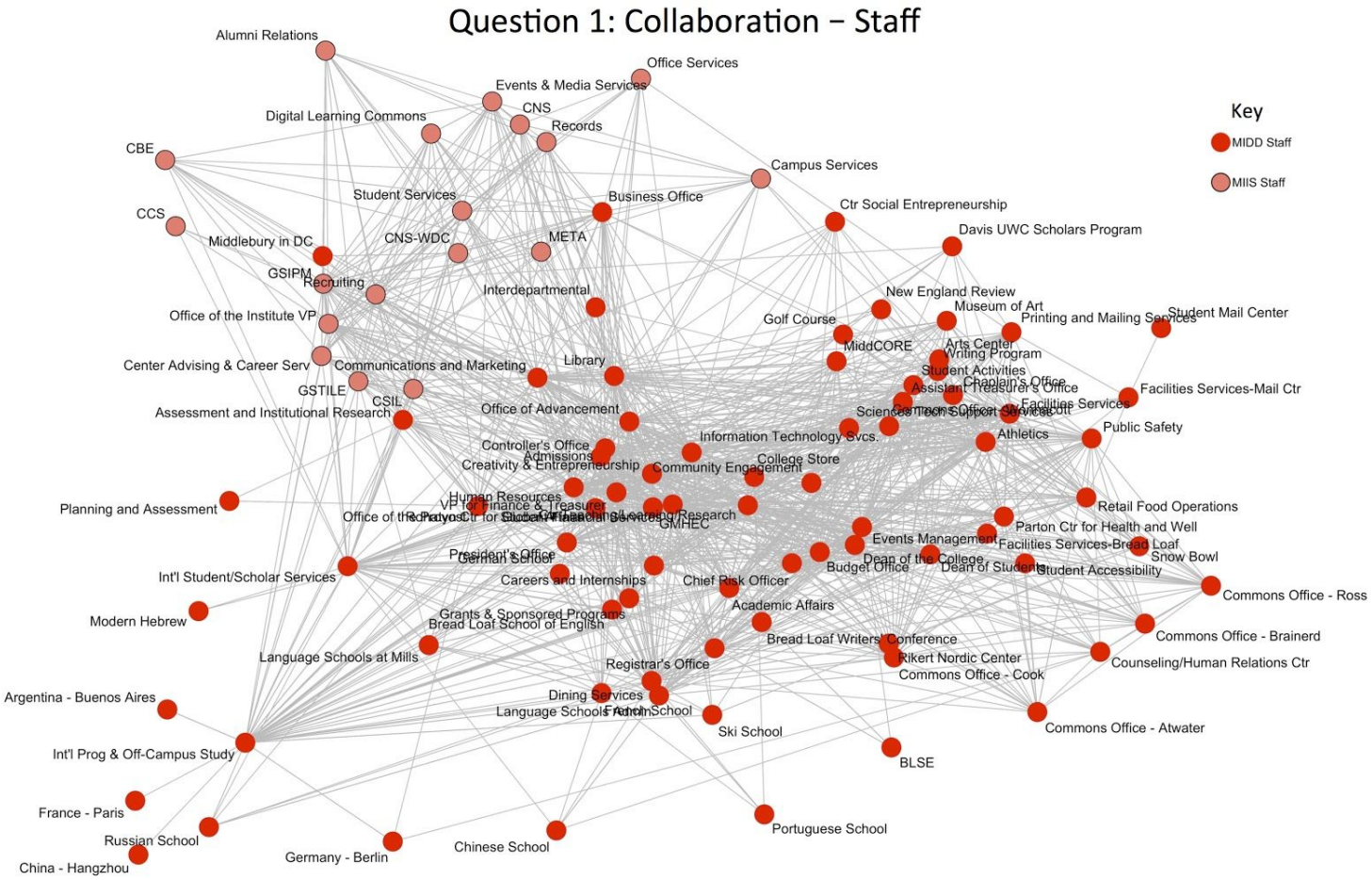

Figure 14: Visualization of the Middlebury Staff collaboration network. The nodes within the network are various administrative and staff offices. Lines between nodes indicate that someone from one office identified someone from the other as a collaborator who "...make[s] it possible for them to perform their work…".

6.1.2 Staff Communication Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you communicate regularly in the course of your work?"

Communication networks map the flow of information within a group or organization.

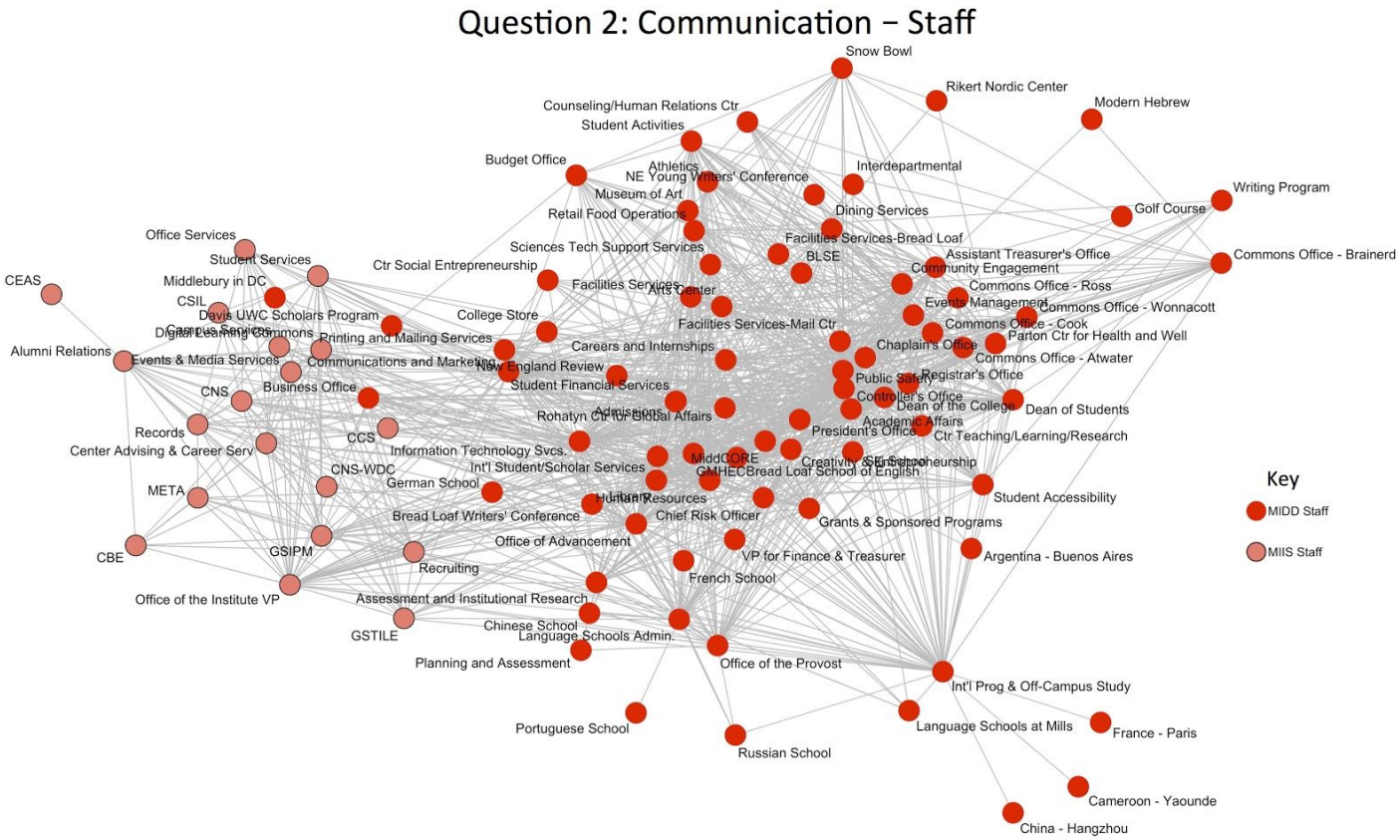

Figure 15: Visualization of the Middlebury Staff communication network. The nodes within the network are various administrative and staff offices. Lines between nodes indicate that someone from one office identified someone from the other as a colleague with whom they "...communicate regularly in the course of [their] work…".

6.1.3 Staff Esteem Network

Eliciting Question:
"Within the Middlebury ecosystem, who are the faculty and/or staff members with whom you aspire to work more closely?"

Esteem is a reflection of aspiration. More than either of the two preceding networks, the esteem network is a relatively direct indication of future ties within the Middlebury ecosystem.

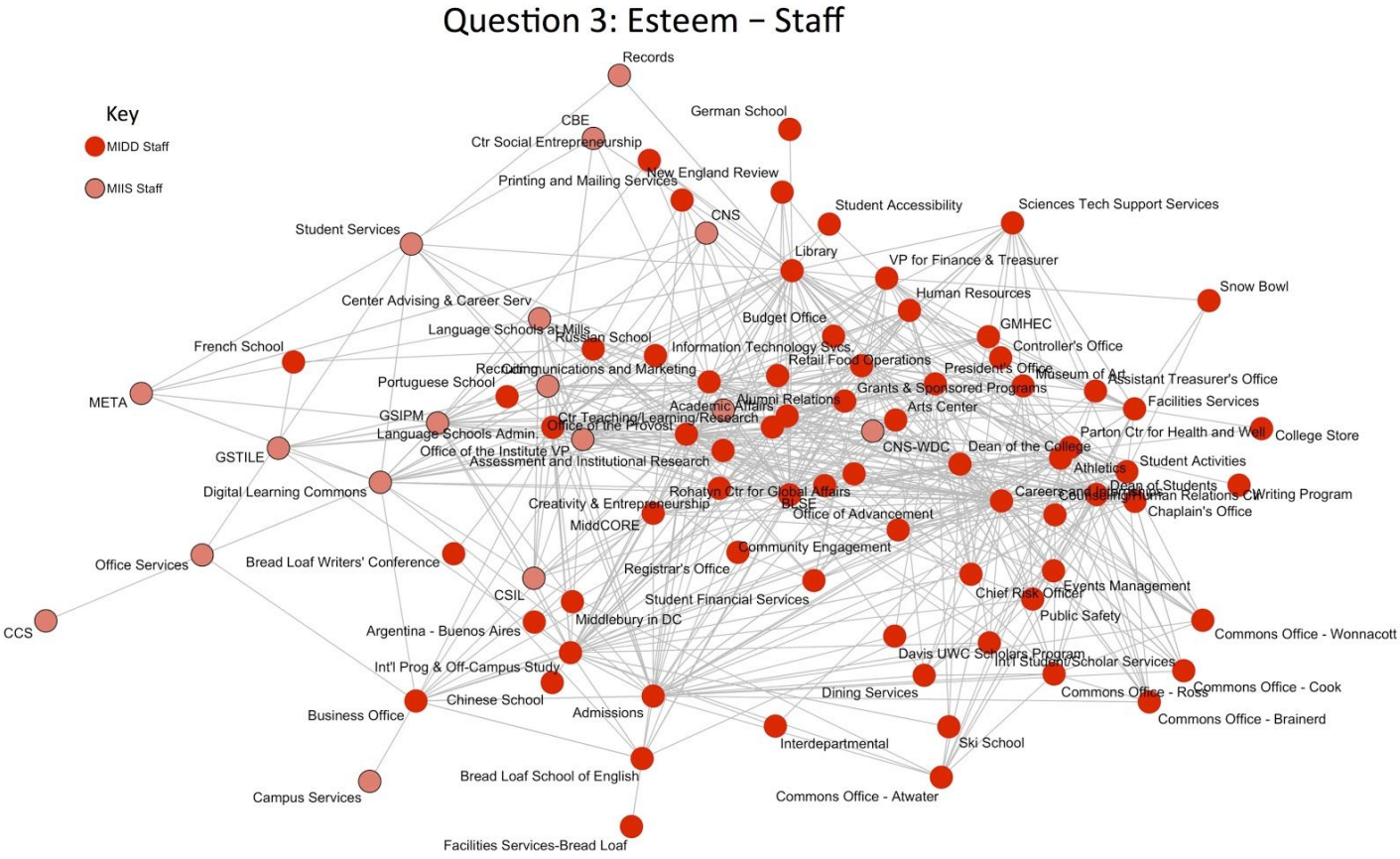

Figure 16: Visualization of the Middlebury Staff esteem network. The nodes within the network are various administrative and staff offices. Lines between nodes indicate that someone from one office identified someone from the other as a collaborator who "...make[s] it possible for them to perform their work…".

6.2 Brief Interpretation of Middlebury Staff Networks

We have already seen that the staff and administrative offices serve as the “glue” holding the Middlebury network together and act as a liaison between faculty from the two campuses. In separating out only staff and administration and their ties to one another, it becomes apparent very quickly that this network is much more densely interconnected than the faculty network.

The Middlebury staff collaboration and communication networks (Figures 14 & 15) depict the connections that exist between staff groups on each campus. As with all other networks in this report, each campus is still easily discerned in these visualizations, but less so than previously seen. There is obviously a good deal of collaboration and communication among staff and administrators from both campus locations already, likely due to their roles in coordination of Middlebury functions.

Esteem is a good indication of some of the unrealized desire for collaboration. As with the faculty network, the potential for greater collaboration between campuses is much more evident in the esteem network (Figure 16). Although the network is more sparsely connected overall, the offices from each school are more inter-tangled than with either the collaboration or communication networks. Most notable are the offices of CNS-WDC and Alumni Relations from Monterey that are centered among Vermont offices, and the French School which is positioned among only Monterey offices.

6.3 Potential Liaisons

As with the faculty network, liaisons among the various aspects of the staff network are identified by the frequency with which they act as a go-between, or bridge, linking two dissimilar others. Once again, “dissimilar” refers to differences between location only. In this manner, a liaison can be seen as an entity that mediates or encourages contact between others. The mediation or encouragement exerted by the liaison is not generally expected to be overt. Rather, much of the liaison effect on tie formation arises due to the increased network proximity that comes about as a liaison draws together dissimilar others within the network. Increased proximity - in terms of the ties within the network - increases the chances of a direct tie forming between the otherwise unconnected individuals.

As you consider the charts in Figure 17 and Figure 18 (below) make it a practice to consult the visualizations above. Also keep in mind that liaisons within the collaboration network are essentially functioning as resource brokers, and liaisons within the communication network hold the potential to function as information brokers.

The charts below present offices that function as a liaison, or go-between, connecting two offices from the two different campuses, regardless of which campus the liaison office occupies.

Again, keep in mind that this measure is only an indication of potential.

Note: For the full results of this and other measures, visit the companion website to this report: https://sites.google.com/site/middleburysna/

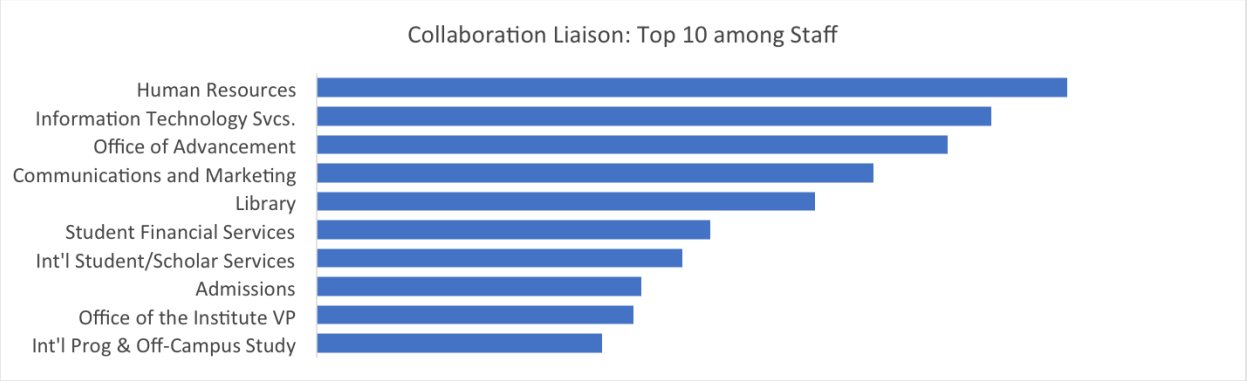

Figure 17: Top ten staff or administrative liaisons from the staff only *collaboration* network. Liaisons are measured as the frequency with which an office acts as a connection between the two campus locations. Longer bars indicate a greater potential for acting as a liaison.

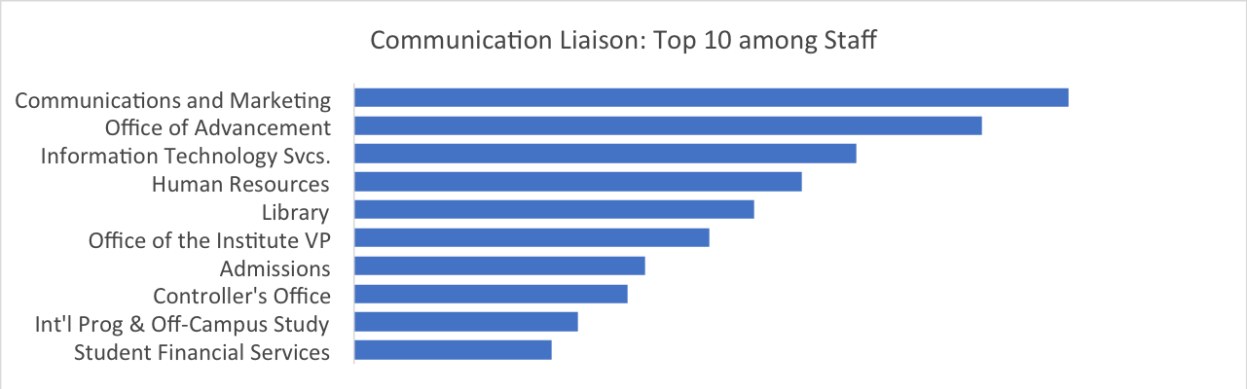

Figure 18: Top ten staff liaisons from the staff only *communication* network. Liaisons are measured as the frequency with which an office acts as a connection between the two campus locations. Longer bars indicate a greater potential for acting as a liaison.

6.4 Throughflow within the Network

The concept of network centrality can also offer insights into the workings of the Middlebury staff network. Given that throughflow is a measure of relative efficiencies within a network, it is important to note that the measure is also subject to distortions within a network. Throughflow is calculated as the offices that lay most frequently on the shortest path between any two others in the network. Therefore, it is vulnerable to instances when a particular set of offices are connected with just one other office.

Such is the case with International Programs and Off-Campus Studies. Three programs - Argentina, China, and France - are connected with that program and no other. All other offices would have to go through the International Programs office in order to reach the other three in either of the measured network aspects. Under such conditions, the relative prominence of International Programs will appear to be inflated in either of the measured network aspects.

We may, therefore, consider the measure of throughflow for International Programs to be somewhat over-inflated in these networks. Otherwise, the remaining offices that have been identified as occupying *critical junctures* within a network are more accurate representations of this measure.

As with the liaison measures, refer back to the visualizations above as you consult these charts. Think of high throughflow as a position of potential influence within the network.

The charts below observe the critical junctures or “throughflow” among the faculty only networks for questions 1 and 2, Collaboration and Communication, respectively. Central positions within the network are indicated by longer bars (with the noted exception of International Programs and Off-Campus Study).

Note: For the full results of this and other measures, visit the companion website to this report: https://sites.google.com/site/middleburysna/

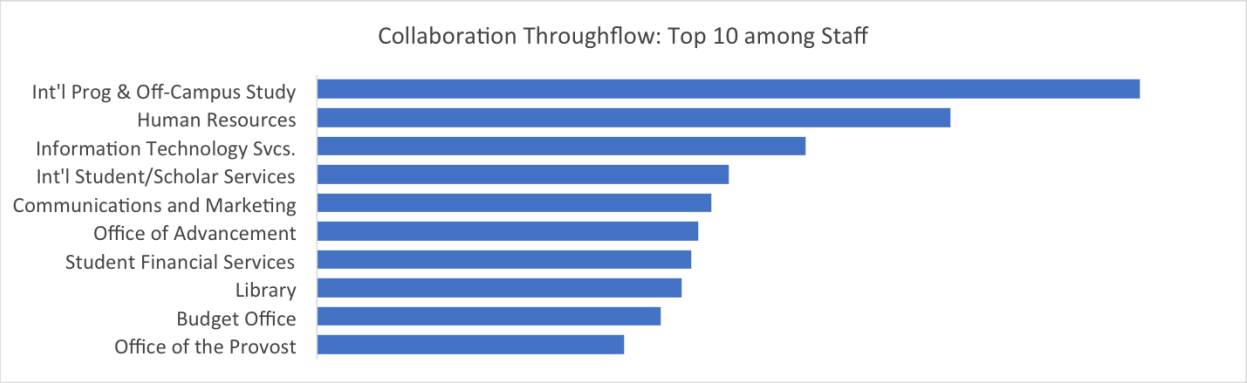

Figure 19: Top ten staff or administrative offices in terms of occupying “critical junctures” in the staff only *collaboration* network. Critical junctures, or “throughflow”, refers to the frequency with which groups lay on the shortest path between any two others in the network. Longer bars indicate that an office occupies a space in the network that is in the shortest path between any two others more often. Longer bars indicate more “central” positions in the network.

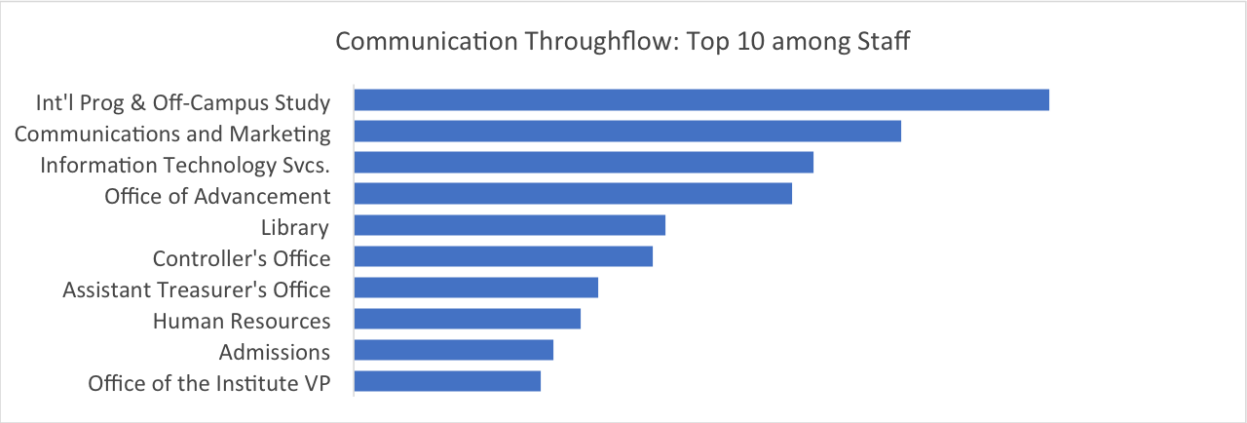

Figure 20: Top ten staff or administrative offices in terms of occupying “critical junctures” in the staff only *communication* network. Critical junctures, or “throughflow”, refers to the frequency with which groups lay on the shortest path between any two others in the network. Longer bars indicate that an office occupies a space in the network that is in the shortest path between any two others more often. Longer bars indicate more “central” positions in the network.

6.5 Section Summary

Subsetting the Middlebury network revealed far more integration within staff and administration in the collaboration and communication aspects than was present in the Middlebury faculty networks. Additionally, the esteem network was similarly more egalitarian, indicating a great deal of potential for future ties.

In similar fashion, there are also substantially more staff offices that score high in terms of liaison and throughflow. This could, in part, be due to the comparatively larger set of staff offices than faculty. It is more likely, however, due to the density of interconnections within the staff network.

This is, most likely, the result of administrative structures, and the connectivity among their component, being the result of purposeful design. Conversely, academic structures are designed around their output (e.g. a degree map) and not necessarily the connectivity among the various constituents engaged in its production.

As with the Middlebury faculty network, it is important to pay particular attention to offices that score strongly on both liaison and throughflow, and appear to be particularly active between campuses within the faculty esteem network. Those offices are likely to represent easily reachable opportunities for further integration between campuses. As discussed above, any new ties that draw disparate groups closer together hold the potential to engender still more ties between other disparate groups in the future.

7 Concluding Remarks

The mere experience of having collected data on the nature and intensity of existing or desired connections among colleagues over such a large and complex structure is in itself a tremendous accomplishment. As shown in the body of the report, some of the findings were confirmatory of what one might expect about the Middlebury ecosystem, while others were true discoveries. It is possible that a more extensive dataset would have provided more robust results, but the findings are of relevant significance for the intended purpose: the exploration of current and future relationships among the members of the Middlebury community in the context of a broad-base strategic envisioning initiative.

This work is intended to inform the reader as to aspects of the Middlebury ecosystem that may not be immediately clear upon casual examination. A small collection of measures and concepts have been presented in the course of this report. Each of these should provide a different form of insight into the potential behavior and abilities of various offices, departments, and programs within Middlebury. It is strongly suggested that these be used as an indication of *potential for*, rather than determinants in, the continued growth of the Middlebury ecosystem.

There much more to be done in the context of a social network analysis of the Middlebury ecosystem. This report only includes relatively few techniques, considering the vast array of metrics still available to the analysts. The work continues and we are open to suggestions that will enhance the exploration of additional issues.